Environmentally Preferable Product Report

# Toxic Flame Retardants — The Buzz on PBDEs

Hazardous Waste and Toxics Reduction Program

## Brominated flame retardants cause health concerns.

Flame retardants are chemicals added to plastics, foams, and textiles as a fire-safety measure. There are hundreds of different types of flame retardants in use. This report discusses the phase-out of one class of these flame retardants, polybrominated diphenyl ethers (PBDEs). PBDEs have been found in increasingly high concentrations in human breast milk, supermarket foods, and household dust— a cause for great concern.

## Brominated Flame Retardants

PBDEs have been applied to plastic and foam products since the 1960's. They inhibit fire by releasing bromine atoms which deprive air of oxygen needed to feed fire. PBDEs fall in the category of persistent, bioaccumulative toxins (PBTs)— those that remain in the environment for long periods of time, and buildup through the food chain in fish, animals and humans. PBTs pose health risks to all of Earth's species.

Until recently, three mixtures of PBDEs, penta-BDE, octa-BDE and deca-BDE, were commercially produced. However, as a result of their alarming increase in the environment, two forms of PBDEs, the octa and penta forms, were voluntarily phased-out by chemical manufacturers in the U.S.

The remaining PBDE, deca-BDE, or Deca, is primarily used in electronic equipment. Approximately 80% of its use is directed toward the specific task of fire-proofing electronic encasements used for the back and front plates of television sets and computers. Its second-most-common application is textile safety, specifically for mattresses and office furniture. Textile applications account for 10-20% of Deca use. Recent studies suggest that Deca can break down into other more toxic PBDEs.

## PBDEs and Human Health

- PBDEs leach out of products. They enter the environment and show up in air, household dust, soil and sediment. Because PBDEs accumulate in animals at the top of the food chain, **the Puget Sound orca whale has become one of the most contaminated animals in the world.**
- In their structure and effects, PBDEs show a striking similarity to polychlorinated biphenyls (PCBs). This similarity is a cause for concern because the production of PCBs was banned in the 1970s, yet they are still present in our environment.
- PBDE levels in humans are 10-100 times higher in the U.S. than in Europe. North American levels appear to be rising at an exponential rate, **doubling every 2-5 years**.
- A study conducted in 2004, on 40 mothers from Washington, Oregon, British Columbia and Montana, found PBDEs in the breast milk of every woman tested. Breast milk contamination levels indicate the level of toxic exposure experienced by the developing fetus.

According to the Washington State PBDE Chemical Action Plan, little is known about the environmental and human health risks of chemical flame retardants. Many of them pose some hazard of persistence, bioaccumulation and/or eco-toxicity. Any fire protection method which does not involve chemical flame retardants should be seriously considered.

Total PBDE levels in human blood and tissues have increased by a factor of 100 since the 1970's. For some animals, such as Lake Ontario trout and San Francisco Bay harbor seals, the 100-fold increase has occurred even more rapidly, over a 10-20 year time span.

## Alternatives to PBDE Flame Retardants

There are three alternatives to PBDE flame retardants: product redesign, choosing products that are inherently less flammable and less-toxic non-PBT alternatives.

### Product Redesign

Products can be redesigned to create a greater distance between their ignitable material and potential source of ignition. Redesigning products greatly reduces the need for chemical flame retardants.

- **Electronics** can be designed so power supplies are shielded with metal components. Another product redesign method involves removing the power supply from the product (such is currently done with printers and rechargeable phones).

- **Textile** redesign may involve reducing the amount of ignitable foam used in upholstered furniture or may involve the use of a barrier layer between the surface fabric and the interior foam core. The fire-barrier method is able to meet more stringent fire safety standards than chemical flame retardants can meet. The fire-barrier method is used in mattresses in institutional settings such as nursing homes and hospitals.

### Inherently Less Flammable Materials

- **Electronics** The type and amount of flame retardants required for an electronic encasement depends on its plastic composition. Encasements made out of polycarbonate, blends of high-impact polystyrene and polyphenyl oxide, or blends of polycarbonate and acrylonitrile-butadiene-styrene are preferable.

- **Textiles** Fibers used in high performance apparel such as fire fighter gear are made out of melamine, polyaramides, carbonized acrylic and glass. These materials do not require an added flame retardant. **Fibers with varying degrees of flame retardancy can be blended to meet different demands for cost, comfort, and safety.**

### Alternative Chemicals

- **Electronics** Although there are some chemical alternatives for PBDEs, their potential for environmental and human health effects is generally not well studied. Resorcinol bis (diphenylphosphate) and triphenyl phosphate are less persistent and less likely to bioaccumulate than PBDEs, however the ecotoxicity of these chemicals is a major concern. According to the American Public Health Association the German EPA determined aluminum trihydroxide, red phosphorus, and ammonium polyphosphate as the chemical alternatives with the least environmental impact[1].

- **Textiles** It is difficult to use alternatives to deca-BDEs with synthetic fabrics such as acrylic, acetate, nylon, and polypropylene. Natural cellulosic fibers like wool, cotton, rayon, and linen are easier to flame retard with chemical alternatives.

[1] American Public Health Association (APHA). (2004). *Preventing Human Exposure to Polybrominated Biphenyl Ethers Flame Retardants to Protect Public Health,* Retrieved 10/18/06 from *http://www.apha.org/private/2004_Proposed_Policies/B5_2004.pdf*

## Purchasing Alternatives to PBDE Flame Retardants

When developing contracts, specify products that do not contain PBDEs. To ensure the product is PBDE-free, product manufacturers may obtain information from the producer of the foam, plastic, or other material in which the flame retardant has been blended. PBDEs are most commonly found in computers, televisions, mattresses, drapery, commercial upholstered furniture, and textiles used in the automotive and airplane industries.

State Contract 05904 sells yurt kits with wall and roof materials that are PBDE-free and that meet fire safety standards.

### Companies are making the switch

- IKEA Furniture, Eddie Bauer, and Crate and Barrel use PBDE-free polyurethane foam provided by furniture manufacturer Hickory Springs.
- Dell, Apple, Ericsson, IBM, Intel, Motorola, Sony, and Toshiba no longer use deca-BDEs in electronic encasements.
- In Europe resorcinol bis diphenyl phosphate is used to retard flame in electronic encasements for television sets.
- Lifekind, Gaiam, IKEA, Ecobaby, and Natura Sleep Systems provide PBDE-free mattresses and cribs.

### Meeting fire-safety needs

Over three hundred codes regulate fire safety for buildings, services, processes, designs, and installation[2]. There are a variety of product designs and flame retardant techniques available to meet fire safety measures. **Deca and other persistent bioaccumulative flame retardants should only be used if no other flame-retardant methods are available.**

**Electronics** sold in the U.S. must meet the fire safety standards established by The National Fire Protection Association.

**Toxicity and Fires**
The toxicity of a fire depends on materials being burned. When considering fire safety, it is not only important to choose products that meet fire safety standards with PBDE-free flame retardants, but also to consider the product's primary material. For instance, natural fibers are less toxic upon ignition than synthetic fibers.

Previously, fire safety standards for **textile** products were developed for smoldering flame. Now, textile products must meet open-flame test requirements. The State of California Bureau of Home Furnishings and Thermal Insulation and the Consumer Product Safety Commission are leading a change to create stricter safety regulations for textiles used in mattresses, furniture and bedding.

## Washington's Goal of Reducing Toxic Chemicals

Governor Locke, through Executive Order 04-01 on *Persistent Toxins*, showed a commitment to reducing the threats of the most toxic chemicals, including PBDEs. Under this Order:

**1.** In January 2006, The Departments of Ecology and Health completed a chemical action plan on PBDEs. The plan identifies actions the state can take to reduce threats posed by persistent bioaccumulative toxic chemicals found in flame retardants and it recommends steps for implementation.

[2] National Fire Protection Agency (NFPA). (2005). *TrendsL The U.S. Fire Problem*. Retrieved 5/15/06, from http://ww.nfpa.org/itemDetail.asp?categoryID=953&itemID=23033&URL=Research%20&%20Reports/Fire%20statistics/Trends

2. General Administration is called to make available for purchase goods that do not contain persistent bioaccumulative toxic chemicals, unless there is no feasible alternative.
3. Each state agency is required to adopt measures to reduce use of equipment, supplies, and other products containing PBTs.

### National and international initiatives addressing PBDEs

- The octa and penta forms of PBDEs were banned in the European Union in 2004.
- The California legislature passed a law prohibiting the manufacture of penta-BDEs and octa-BDEs, effective July 2006.
- On July 1, 2006, the European Union enacted the Restriction of Hazardous Substances (RoHS) directive. This directive restricts lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls and PBDEs in electrical and electronic equipment sold or used in the European Union.

## For Further Information

To learn more about the environmental and human health effects of PBDEs:

**PBDE Flame Retardants**
Washington State Department of Ecology www.ecy.wa.gov/programs/eap/pbt/pbde

**Washington State PBDE Chemical Action Plan**
Washington State Department of Ecology and Washington State Department of Health
www.ecy.wa.gov/biblio/0507048.html

**Growing Threats: Toxic Flame Retardants and Children's Health**
Environment California Research & Policy Center
www.environmentcalifornia.org/growing-threats-toxic-flame-retardants-and-childrens-health

**Northwest Women Contaminated With Toxic Flame Retardants**
Washington Toxics Coalition
www.watoxics.org/pressroom/press-releases/pr-2004-09-29

To learn more about alternatives to PBDEs:

**Learning Hazards: Toxic Fire Retardants and How to Avoid Them In Consumer Products and Food**
Washington Toxics Coalition
www.watoxics.org/files/GreenProductGuide.pdf

**Dedcabromodiphenylether: An Investigation of Non-Halogen Substitutes in Electronic Enclosures and Textile Applications**
Lowell Center for Sustainable Production
www.sustainableproduction.org/downloads/DecaBDESubstitutesFinal4-15-05.pdf